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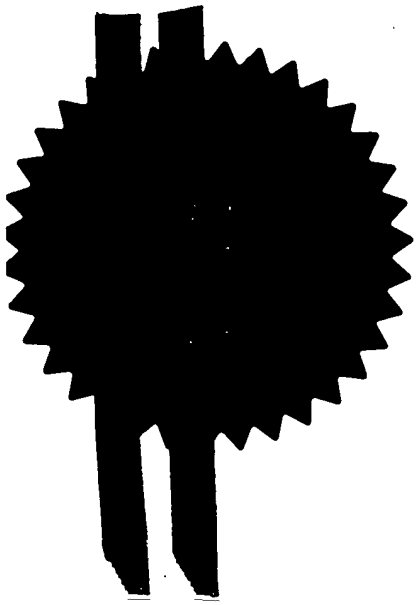

Signed K A Richards

Dated 5 September 2000

Patents Act 1977
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Patent Office

1/77

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office
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1. Your reference
M99/0596/GB

2. Patent a
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9921618.6
14 SEP 1999

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*
Reflec plc
Road One
Winsford Industrial Estate
Winsford
Cheshire CW7 3QQ

Patents ADP number *(if you know it)*
7737984001

If the applicant is a corporate body, give the country/state of its incorporation
Great Britain

4. Title of the invention
Retroreflective Materials

5. Name of your agent *(if you have one)*
McNeight & Lawrence
Regent House
Heaton Lane
Stockport
Cheshire
SK4 1BS

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Patents ADP number *(if you know it)*
0001115001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicants is a corporate body.
See note (d))
Yes

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	9 ✓
Claim(s)	1 ✓
Abstract	–
Drawing(s)	–

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature McNeight & Lawrence Date 14.09.99

12. Name and daytime telephone number of person to contact in the United Kingdom David L McNeight 0161 480 6394

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RETROREFLECTIVE MATERIALS

This invention relates to retroreflective materials, and particularly to such materials as are proposed in GB 2 321 565 for use as studio background material for chroma-keying and like purposes.

According to GB 2 321 565, such materials are made of a flexible sheet material coated with a plurality of retroreflective particles, randomly orientated. Usually, the retroreflective particles are glass microbeads which have been hemispherically coated with aluminium. In order to provide for high retroreflectivity at angles of incidence other than normal to the surface, GB 2 321 565 teaches that the material surface is not smooth, but has hills and troughs of size comparable to the diameter of the beads so that when viewed from an oblique angle, a substantial proportion of the spheres will be visible. This is said to produce substantially uniform reflectivity over a wide range of entrance angles.

Such uniformity is, of course, highly desirable for chroma-keying as well as for virtual studio effects, produced by projecting an image from the camera position on to a retroreflective background. Actors and props which do not retroreflect are not noticeably illuminated by the projection and appear to the camera to be in front of a real background. In situations where the viewing angle is wide, or where cameras are mobile, it is clearly important that the virtual image or chroma-key colour is of the same intensity from any angle.

GB 2 321 565 claims to achieve a normalised retro-reflectivity of at least about ¼ at an angle of incidence of at leat 60 degrees to the normal.

The retroreflective fabric is made, according to GB 2 321 565, by spray-coating or painting a thin layer of adhesive on to the cloth, or applying a thin flexible sheet adhesive, for example that available from 3M Corporation under the trade name "Scotch". Suitable reflective spherical particles are said to be available from 3M as part of their reflective ink Kit 8010. These are intended to be embedded in an adhesive supplied with the ink Kit and applied to a smooth surface as a reflective ink. Improved performance is, however, said to be achieved, particularly at large angles of incidence, if the particles are disposed on a separate adhesive layer, i.e. not used in an ink formulation.

GB 2 321 565 shows in graphical form (Figure 4) a comparison of the normalised gain of a conventional retro-reflective sheet material (as sold by 3M) and of a retro-reflective material according to the method of the invention of GB 2 321 575, from which it can be seen clearly that the invention provides more uniform reflectivity, particularly at large angles of incidence.

The present invention provides retroreflective studio background materials, and methods for making the same, which have improved performance, in terms of uniformity of normalised gain, and which are easier to make, as well as being more versatile.

The invention comprises a retroreflective studio background material comprising a fabric which is printed or coated with a one-pack ink comprising retroreflective elements in a polymer matrix, the fabric having a surface structure such that retroreflectivity remains substantially uniform from normal (0°) to high (60°+) angles of incidence.

The material may comprise a woven fabric having conspicuous warp and weft crowns, or it may comprise a knitted fabric having a conspicuous stitch structure. In either event, the "grain" of the fabric is preferably less than the resolution of a camera at the intended minimum camera - backdrop distance.

The material may be printed or coated in solid colour for chroma-keying, or it may be printed in a pattern or design. The material may be printed in difference colours of retroreflective ink, or may be printed or coated in a single colour of retroreflective ink and over-printed with a pattern or design, as by transfer, e.g. heat transfer printing.

Especially in studio situations where lighting gives rise to elevated temperatures and low relative humidity, creating an increased fire hazard, the material is made fire or flame retardant. To this end, the fabric may comprise a structural component that chars before it melts, and may be or contain, for example, cotton or other cellulosic fibres to which a fire retardant agent has been applied. The fabric may however comprise an inherently non-flam fibre.

The ink may be non-burning once applied to the fabric, and the polymeric matrix may comprise polyvinylidene chloride or polyvinyl chloride, in an aqueous ink system, or a non-flam plastisol.

Examples of inks suitable for printing or coating the fabrics are:

Table I - inks based on a polyvinylidene chloride copolymer binder system and (3-aminopropyl) silanetriol coupling agent

Ingredient/Ink reference	**V246**	**V248**	**V251**
Urea (Humectant)	10	10	10
Water	128	288	288
Ammonium phosphate buffer	20	20	20
Emulsifier WN (Dispersant)	3	3	3
Agitan 218 (Defoamer)	2	2	2
Alcoprint PT21 (Thickening agent)	8	8	8
2,3 Propane diol (Humectant)	25	25	25
Polidene 33-048 (Binder)	273	163	163
Ammonium hydroxide	1.4	1.4	1.4
Silquest VS-142 (Coupling agent) [20% in water]	25	25	25
Alcoprint PT21 (Thickening agent)	3	5	3
Metallised beads (40 micron) treated with sodium silicate and Silquest A-1170	500	450	400
Non-metallised beads (40 micron) treated with sodium silicate and Silquest A-1170	--	--	50
Total Weight of Ink (g)	998.4	1,000.4	998.4
Binder volume %	15	9	9
Bead volume %	20	18	18
Binder volume/bead volume %	75	50	50
Viscosity (pascals)	25.6	14.2	12.3
Temperature (°C)	17.7	17.6	17.2
pH	8.6	8.7	8.7

Table II - inks based on a polyvinylidene copolymer binder system and a combination of (3-aminopropyl) silanetriol and blocked hexamethylene diisocyanate trimer coupling agents

Ingredient/Ink reference	**V253**	**V254**	**V257**
Urea (Humectant)	10	10	10
Water	91	183	183
Ammonium phosphate buffer	20	20	20
Emulsifier WN (Dispersant)	2	2	2
Emulsifier HVN (Dispersant)	2	2	2
Agitan 218 (Defoamer)	2	2	2
Alcoprint PT21 (Thickening agent)	9.3	8	8
2,3 Propane diol (Humectant)	25	25	25
Polidene 33-048 (Binder)	273	181	181
Ammonium hydroxide	1.4	1.4	1.4
Silquest VS-142 (Coupling agent) [20% in water]	25	25	25
Trixene BI 7986 (Coupling agent)	40	40	40
Alcoprint PT21 (Thickening agent)	--	--	--
Metallised beads (40 micron) treated with sodium silicate and Silquest A-1170	500	500	400
Non-metallised beads treated with sodium silicate and Silquest A-1170	--	--	100
Total Weight of Ink (g)	1,000.7	999.4	999.4
Binder Volume %	15	10	10
Bead Volumes %	20	20	20
Binder Volume/Bead Volume Ratio %	75	50	50
Viscosity (pascals)	22.5	22.1	21.2
Temperature (°C)	19.3	19.0	19.0
pH	8.4	8.3	8.4

Generally speaking, the ingredients are added in the tabulated order. The thickener is added in two stages. Pigment, not tabulated, is added at the end in suitable quantity to yield the desired colour.

Viscosities were measured with a Brookfield viscometer using a number 5 spindle rotating at 10 rpm.

The suitability of any given fabric for use as a retroreflective studio background can be readily determined by printing or coating a sample and making the appropriate measurements. It is not at this time possible to predict precisely the performance of a fabric, though further development may enable this to be done from surface parameters.

Of importance also is the fact that it may not always be required to have a perfectly retro-reflective surface (or one as perfectly retro-reflective as possible). Combining the inks with different surfaces can produce, for example, a bright screen for projection in which light incident from a projector is reflected back over an angular extent corresponding to a viewing seating plan. The inks can indeed be applied to any surface, e.g. to a plaster wall, wood or metal surface, or to paper, to make an inexpensive viewing screen.

In one application, an outdoor viewing screen can comprise a lattice e.g. of polyvinyl chloride, say 10m x 12m in size, the lattice being waterproof but air permeable so as to be stable even in windy conditions. This is an example where the high resolution required for broadcast standard imaging (including chroma-keying) may be replaced by a lower resolution.

Less-than-perfectly retroreflective backdrops, screen and other surfaces may be used in connection with domestic, or undemanding commercial video. The inks,

however, may be of the same specification, the difference being in the choice of surface or substrate.

The inks may, of course, be applied in any convenient manner. They can be printed using conventional screen or other printing techniques (the microbeads can be made small enough to pass through fine mesh screens), sprayed, coated and painted by brush or roller, for example.

As mentioned, the inks may be fire or flame retardant and may be applied to fire or flame retardant substrates, which is of importance in domestic and commercial situations as well as in broadcast and professional video and film studios.

The inks specified in the Examples are also wash resistant.

Other inks are specified in Examples III and IV below

Table III - inks based on a acrylic copolymer binder system and (3-aminopropyl) silanetriol coupling agent

Ingredient/Ink reference	C202	C205	C208
Urea (Humectant)	10	10	10
Water	154	179	179
Ammonium phosphate buffer	20	20	20
Alcoprint PDN (Dispersant)	2	2	2
Agitan 218 (Defoamer)	2	2	2
Alcoprint PT21 (Thickening agent)	8	8	8
2,3 Propane diol (Humectant)	25	25	25
Alcoprint PFL (Trimethoxymethyl melamine cross-linking agent)	15	15	15
Alcoprint PSM (Softening agent)	30	30	30
Alcoprint PBA (Acrylic copolymer binder)	300	225	225
Ammonium hydroxide	1	1	1
Silquest VS-142 (3-aminopropyl			

silanetriol coupling agent) [20% in water]	25	25	25
Alcoprint PT21 (Thickening agent)	6	3	4.6
Metallised beads (40 micron) treated with sodium silicate and Silquest A-1170 (Bis[trimethoxysilylpropyl] amine)	400	450	400
Nonmetallised beads (40 micron) treated with sodium silicate and Silquest A-1170	--	--	50
Total	997	995	996.6
Binder volume %	12	9	9
Bead volume %	16	18	18
Binder volume/bead volume %	75	50	50
Viscosity	20.7	16.2	23.2
Temperature	16.6	16.6	16.6
pH	8.4	8.9	8.8

Table IV - inks based on a polyurethane binder system and a blocked 1,6 hexamethylene diisocyanate trimer coupling agent

Ingredient/Ink reference	**P96**	**P98**	**P102**
Urea (Humectant)	10	10	10
Water	62	187	187
Sodium Phosphate Buffer	10	10	10
Emulsifier WN (Dispersant)	3	3	3
Agitan 218 (Defoamer)	2	2	2
Alcoprint PT21 (Thickener)	3.0	3.1	3.0
2,3 Propane diol (Humectant)	25	25	25.1
Alcoprint PSM (Softener)	30	30	30
Witcobond 769 (Binder)	300	225	226
Trixene BI-7986 (Coupler)	50	50	50
Alcoprint PT21 (Thickener)	0.7	4.0	3.0
Metallised beads treated with sod.silicate and Silquest A-1170	500	450	400
Non-metallised beads treated with sod.silicate and Silquest A-1170	--	--	70

Total Weight of Ink (g)	993.7	999.1	1,019.1
Binder Volume %	12	9	8.8
Bead Volume %	60	18	18.5
Binder Volume/Bead Volume Ratio %	60	50	47.9
Viscosity (pascals)	O/R	31.0	32.0
Temperature (°C)	18.8	18.2	18.5

These may be suitable for application to some surfaces.

As well as (or in some instances instead of) mircrobeads, retroreflectivity may be achieved by flake material, e.g. flake mica, and unmetallised beads may be used in conjunction with such flake material or with metallised beads to create special effects.

The inks may be coloured e.g. by incorporating pigments.

While one-pack inks have been particularly referred to, it would, of course, be possible to provide ingredients separately, e.g. binder, beads and pigment, so that an appropriate bead size and pigment colour could be selected at time of use. There are, however, clear advantages to be had from a one-pack system inasmuch as control over the manufacture will ensure a constant quality level, not to mention the trouble saved in mixing. The various treatments involved, however, in connection with the one-pack formulation render the inks suitable for all the purposes described herein, notwithstanding that the ink, for whatever reason, might be presented as a two or three pack system.

CLAIMS

1. A retroreflective studio background material comprising a fabric which is printed or coated with a one-pack ink comprising retroreflective elements in a polymeric matrix, the fabric having a surface structure such that retroreflectivity remains substantially uniform from normal (0°) to high (60°+) angles of incidence.

2. A material according to claim 1, comprising a woven fabric having conspicuous warp and weft crowns.

3. A material according to claim 1, comprising a knitted fabric having a conspicuous stitch structure.

4. A material according to any one of claims 1 to 3, printed or coated in solid colour for chroma-keying.

5. A material according to any one of claims 1 to 3, printed in a pattern or design.

6. A material according to claim 5, printed in different colours of retroreflective ink.

7. A material according to claim 5, printed or coated in a single colour of retroreflective ink and overprinted with a pattern or design.

8. A material according to claim 7, in which the overprinting is by transfer, e.g. heat transfer printing.

9. A material according to any one of claims 1 to 8, which is fire or flame retardant.